

and mobile services could render the band unusable for atmospheric sensing measurements by the Earth exploration-satellite service.

The band 65-71 GHz has been proposed as a useful alternative for commercial LEO satellite crosslinks. Such an allocation would require demonstration of the feasibility of sharing with the existing allocated service systems. If preliminary coordination does not reveal any major obstacles it may be proposed that a future WRC agenda include allocation of the 65-71 GHz band to the inter-satellite service with co-equal primary status.

#### **5.5.5.1 The Teledesic Corporation Paper**

Teledesic Corporation has introduced a document into IWG-5 [IWG-5/35] which supports the inclusion on the WRC-97 agenda of an allocation of the 65-71 GHz band to the inter-satellite service on a co-primary basis. That paper is contained in Section 5.6.1.

## **5.6. Appendices**

### **5.6.1. Proposals and Position Papers**

### **5.6.2. List of IWG-5 Participants**

### **5.6.3. List of IWG-5 Documents**

### **4.5.4. Definition of Terms and List of Acronyms**

### **5.6.1. Proposals and Position Papers**

This Section contains the following draft United States Proposals and Position Papers:

1. Draft U.S. Proposal for Agenda Item 2.2
2. Draft U.S. Proposal for Agenda Item 2.3
3. Teledesic Paper in Support of an Additional Frequency Allocation Near 60 GHz for the Inter-Satellite Service
4. Orbital Sciences Corporation Paper in Support of a Worldwide Upgrade to the Earth Exploration-Satellite Service Allocation in the 8025-8400 MHz Band

**WRC-95 Industry Advisory Committee  
Informal Working Group (IWG-5)**

**Draft U.S. Proposal for Agenda Item 2.2**

1. TITLE:

Power Limits for Earth Stations in the Space Science Services in the Band 2025-2110 MHz

2. CONFERENCE AGENDA ITEM:

"2.2 to consider power limits for earth stations in the Earth exploration-satellite, space research, and space operation services in the band 2025-2110 MHz;"

3. U.S. PROPOSAL:

The purpose of the U.S. proposal is to provide appropriate power limits for earth stations in the Earth exploration-satellite, space research, and space operation services in the 2025-2110 MHz band. This U.S. proposal is to add No. 2544 bis to Article 28 of the Radio regulations as follows:

ADD "2544 bis (6) As an exception to the limits given in No. 2541, the equivalent isotropically radiated power (e.i.r.p.) towards the horizon for an earth station in the Earth exploration-satellite service, space research service and space operation service in the 2025-2110 MHz band shall not exceed +XX dBW in any 4 kHz band."

4. ISSUE:

WARC-92 increased the status of the space operation, space research and Earth exploration-satellite services in the band 2025-2110 MHz from Article 14 to primary. WARC-92 did not, however, specify any e.i.r.p. limits for earth stations in these services. This raised some concern since the band is shared with the fixed and mobile services. Under WRC-95 Agenda Item 2.2, the referenced e.i.r.p. limits would be considered.

Radio Regulations Article 28, No. 2541 provides e.i.r.p. limits for earth stations in frequency bands between 1 and 15 GHz. The reference (No. 2547) explicitly lists services and associated bands for which the limits apply. The space science services are not listed for the 2025-2110 MHz band.

Ad Hoc Working Party 7B/9D has been established to study various sharing conditions, including suitable e.i.r.p. limits for the space services earth stations in the 2025-2110 MHz band. A consensus has yet to emerge. Preliminary assessments indicate that the No. 2541 limits may not be entirely satisfactory from the perspective of the space science services.

5. FOREIGN VIEWS:

A Canadian proposal to WARC-93 for application of the No. 2541 limits to the space research service was not successful. Nevertheless, the Canadians were instrumental in placing this issue on the WRC-95 agenda. It is possible that the Canadians will resurrect their proposal regarding application of the No. 2541 e.i.r.p. limits, especially if no consensus is reached in WP 7B/9D. The current position of other administrations is not known.

6. U.S. POSITION

The U.S. position is to establish appropriate power limits for earth stations in the space science services in the 2025-2110 MHz band.

7. STRATEGY:

It is expected that a WP 7B/9D consensus will be reached and an agreed set of technical parameters will emerge from which the U.S. will propose to satisfy this agenda item. Without consensus, the only viable option for a U.S. proposal may in fact be to propose and justify the preservation of the status quo; that is, continued omission of explicit reference to space science services in Article 28. The option to completely avoid any U.S. proposal whatsoever may not be viable given the possible need to "counter" contrary proposals from other administrations.

8. FALLBACK POSITION:

TBD (Subsequent to final WP 7B/9D report)

9. SUPPORTING REFERENCES:

CPM Report, Section xx.(TBD)

**WRC-95 INDUSTRY ADVISORY COMMITTEE  
INFORMAL WORKING GROUP (IWG-5)**

**DRAFT USA CONFERENCE PROPOSALS FOR THE 13.75-14.0 GHZ BAND  
RESOLUTION 112**

**AGENDA ITEM 2.3**

- MOD 855A** In the band 13.75-14.0 GHz, the e.i.r.p. of any emission from an earth station in the fixed-satellite service shall be at least 68 dBW, and should not exceed 85 dBW, with a minimum antenna diameter of 4.5 meters. In addition the e.i.r.p., averaged over one second, radiated by a station in the radiolocation and radionavigation services towards the geostationary orbit shall not exceed 59 dBW. ~~These values shall apply subject to review by the CCIR and until they are changed by a future competent world administrative radio conference (see Resolution 112).~~ (see Recommendation ITU-R S.1068).
- MOD 855B** In the band 13.75-14.0 GHz geostationary space stations in the space research service, for which information for advance publication has been received by the ~~IFRB~~ ITU-R prior to 31 January 1992, shall operate on an equal basis with stations in the fixed-satellite service; after that date new geostationary space stations in the space research service will operate on a secondary basis. Until 1 January 2000, stations in the fixed-satellite service shall not cause harmful interference to non-geostationary space stations in the space research and earth exploration-satellite services; after that date these non-geostationary space stations will operate on a secondary basis in relation to the fixed-satellite service. (see Recommendations ITU-R S.1069 and ITU-R SA.1071)

## **SUP RESOLUTION 112**

**REASONS:** Resolves 1 of Resolution 112 called for studies, with respect to the values given in No. 855A of the Radio Regulations relating to allocations in the band 13.75-14.0 GHz and to report the outcome at least one year before the next competent conference. ITU-R Task Group 4-4 was formed to perform the necessary studies. This Task Group completed its studies and confirmed the values given in No. 855A. Recommendation ITU-R S.1068 was developed with respect to the sharing of the fixed-satellite service with the radiolocation and radionavigation services.

Resolves 2 of Resolution 112 called for studies with respect to the technical compatibility between the primary allocation to the fixed-satellite service (Earth-to-space) and the secondary allocations to the space research and Earth exploration-satellite services. ITU-R Task group 7-3 was established to study this compatibility taking into account the time frames given in No. 855B. Task Group 7-3 developed protection criteria for the secondary services. Task Group 4-4 considered constraints which would apply to the fixed-satellite service to meet these protection criteria within the time frames given in No. 855B. The two Task Groups, in close consultation, developed two companion Recommendations: ITU-R S.1069 and ITU-R SA.1071. These Recommendations provide further technical details with respect to the compatibility between the fixed-satellite services and these secondary services.

The CPM Report addresses WRC-95 Item 2.3 "to review Resolution 112 in light of the results of studies carried out in application of that Resolution and take appropriate action." The CPM-95 may conclude that all necessary studies have been performed and that the results of these studies, including mutually satisfactory criteria, are contained in the above ITU-R Recommendations. The "appropriate action" with respect to Agenda Item 2.3 is given in the above allocation proposals.



**Additional Frequency Allocation Near 60 GHz  
for the Inter-Satellite Service (ISS)**

Teledesic Corporation has applied to the FCC for a license to build and operate a Non-Geostationary Orbit Fixed-Satellite Service (NGSO-FSS) system that would provide global interconnectivity via wide band (bandwidth on demand) communications. In that application, it is proposed to use 59.5 - 60.5 and 62.5 - 63.5 GHz for inter-satellite links (ISL's) to interconnect the satellites and to provide the message routings between different points on the Earth.

Frequency overlap with another user of the inter-satellite service allocation from 59-64 GHz has led to a request for Teledesic to reposition its ISL frequencies to 56.75 - 57.75 GHz and 59.0 - 60.0 GHz. In the band 54.25 - 58.2 GHz there is a co-primary allocation to the Earth exploration-satellite service for passive sensing of scientifically unique oxygen absorption lines. This band is used to carry out atmospheric temperature measurements on an operational basis that are needed in weather forecasting and climate studies. Teledesic inter-satellite links with their large number of active transmitters in low-earth orbit have the potential to interfere with the Earth pointing passive sensors of the Earth exploration-satellite service.

Thus, to provide for continued growth of satellite communications that would use ISL frequencies near 60 GHz, Teledesic corporation supports the inclusion on the agenda of WRC-97 of:

"The allocation of the band 65.0-71.0 GHz to the Intersatellite Service on a primary basis."

06 December 1994

Ms. Diane Garfield  
Chair, Informal Working Group 5  
Industry Advisory Committee for WRC 95  
U.S. Department of State  
2201 C Street, N.W.  
Room 6312  
Washington, DC 20520-6317

Dear Ms. Garfield:

Orbital Sciences Corporation ("Orbital") is pleased to provide support to the National Aeronautics and Space Administration (NASA) presentation (file number IWG-5/16) to Industry Working Group (IWG) #5. In its letter, NASA presented several important items for consideration as agenda items for WRC-97. Item Number 3 is a request for a global upgrade of the EESS (Earth Exploration Satellite Service). Orbital offers the following comments supporting item Number 3:

*Item 3. (Quoted from NASA letter, IWG-5/16)*  
*Review of the Status of Allocations to Non-sensor EESS and SRS*  
*in the Range 8-20 GHz as specified in Res 712 (WARC-92)*  
*and WRC-97 Agenda Item 2.1*

### **3.1 8025-8400 MHz band**

**REASON:** The 8025-8400 MHz EESS communication band has an inequitable status. It is primary in Region 2 only (subject to Article 14 in Regions 1 and 3) and yet the telemetry from Earth resources sensors has been successfully transmitted to Earth in all three ITU Regions for many years now. Furthermore, the sharing situation in all three regions is equivalent in terms of services allocated. The 8 GHz band is the only band available for wideband EESS data downlinking, for both government and non-government users, below 65 GHz.

**STATUS:** This band is specified in the considerations of Resolution 712 (WARC-92) and is covered in the resolves of that Resolution. Most of the sharing criteria were developed prior to its current allocation status achieved at WARC-1979. Appendix 28 coordination parameters were recently published in ITU-R Recommendation 849 and these should be incorporated into the Radio Regulations as well.

**Orbital RESPONSE:** Orbital supports the above NASA position. The 8025-8400 MHz region, as an EESS band, is a critical resource that requires maximum protection on a global basis. This band is rapidly becoming critical to newly created and licensed private remote sensing systems that plan operations in each ITU Region. Therefore, Orbital believes and supports Resolution 712 and recommends the establishment of a common primary allocation for EESS in the 8025-8400 MHz region on a worldwide basis with appropriate coordination parameters.

In the Land Remote Sensing Commercialization Act(s) of 1984 and 1992 the US Congress recognized that remote sensing serves and benefits the public interest. Space-based remote sensing, which is primarily conducted in frequency bands allocated for EESS, serves the public interest in studying and understanding human impacts on the global environment, in managing the Earth's natural resources, and in planning and conducting many other activities of scientific,

economic and social importance. This represents a significant global benefit and, therefore, justifies a global requirement for primary wideband EESS services.

Orbital supports all efforts for a worldwide upgrade to the EESS allocation in the 8025-8400 MHz band and highly recommends that IWG-5 and the IAC (Industry Advisory Committee) support the NASA recommendation. Comments or questions may be directed to the undersigned at (703) 406-5409.

Sincerely,

**SIGNED and PRESENTED TO IWG-5 CHAIRMAN / 06 DEC 94**

James E. Byrd, Jr.  
Spectrum Management

## 5.6.2 List of Participants

<u>Participant</u>	<u>Organization</u>
Byrd, James	OSC
Cager, Ralph	CSC
Carroll, James R.	SFA
Chestom, T. Stephen	Iridium
Garfield, Diane	State Department
Gutierrez-Luaces, Benito	NASA/JPL
Holiday, Cecily	FCC
Huang, Bob	Comsat World Systems
Hutchinson, Kris	ARINC
Irion, Karyl	CSC
Jansky, Don	Jansky/Barmat
Kiebler, John	MITRE
LaForge, Ray	FCC
Long, Bill	DISA
Manner, Jennifer	Teledesic
May, Bob	USAF
Miller, Edward	Telesesic
Miller, J.E.	STel
Musarra, Gerald	Lockheed
Pattan, Bruno	FCC
Richards, Warren	State Department
Rinaldo, Paul	ARRL
Rinker, Alan	CSC
Sharkey, Steve	FCC
Struba, David	NASA
Taylor, Robert	NASA
Wiggen, Gerry	SFA Inc.
Wilson, Brett	Rockwell
Wright, Rich	CSC

### 5.6.3. List of IWG-5 Documents

<u>Number</u>	<u>Document Title</u>
IWG-5/1	IWG-5 Meeting Agenda June 14
IWG-5/2	Agenda for the 1995 World Radiocommunication Conference
IWG-5/3	Terms of Reference for IWG-5
IWG-5/4	WRC-95 Industry Advisory Committee Proposed Work Program for IWG-5 Space Services
IWG-5/5	Proposed IAC Meeting Schedule
IWG-5/6R	WRC-95 Industry Advisory Committee Meeting Schedule for IWGs 1-5
IWG-5/7	Resolution 112 (WARC-92)
IWG-5/8	Resolution 712 (WARC-92)
IWG-5/9	IWG-5 Meeting Minutes June 14
IWG-5/10	IWG-5 Meeting Agenda July 11
IWG-5/11	Draft New Recommendation [ITU-R SA.DOC. 4/210] - Fixed-Satellite and Radiolocation/Radionavigation Sharing in the Band 13.75-14.0 GHz
IWG-5/12	Draft New Recommendation [ITU-R SA.DOC. 4/211] - Compatibility Between the FSS and the Space Science Services in the Band 13.75-14.0 GHz
IWG-5/13	Draft New Recommendation [ITU-R SA.DOC. 7/125] - Use of the 13.75-14.0 GHz Band by the Space Science Services and the Fixed-Satellite Service
IWG-5/14	Frequency Allocations for Spaceborn Microwave Sensors
IWG-5/15	Draft Proposal to PP-94 - Review of the ITU's Satellite Planning and Coordination Framework
IWG-5/16	NASA Information Document on Issues Currently Under Study
IWG-5/17	Draft U.S. Proposal for Agenda Item 2.2
IWG-5/18	Draft Conference Proposal for the 13.75-14.0 GHz Band - Resolution 112
IWG-5/19R	Liaison Note to IWG-4 on MSS Feeder Links in the 13.75-14.0 GHz Band
IWG-5/20	not assigned
IWG-5/21	IWG-5 Meeting Minutes July 11
IWG-5/22	NASA Information Document on Proposed Use of the Shared Allocation at 54.25-58.2 GHz Between the Earth Exploration and the Inter-Satellite Services
IWG-5/23	IWG-5 Meeting Agenda August 9
IWG-5/24	IWG-5 Meeting Agenda September 7

IWG-5/25	IWG-5 Meeting Minutes August 9
IWG-5/26	IWG-5 Meeting Agenda October 18
IWG-5/27	Reverse Band Working Feeder Links in the 13.75 to 14.0 GHz Frequency Band Sharing With Radiolocation/Radionavigation Services
IWG-5/28	Liaison Note to IWG-4 on RBW Feeder Links in the 13.75-14.0 GHz Band Sharing with Radionavigation/Radiolocation
IWG-5/29	Information Document - Resolution 712 (WARC-92) Issues
IWG-5/30	Information Document - WRC Issues Other than Resolution 712
IWG-5/31	IWG-5 Meeting Minutes September 7
IWG-5/32	Liaison Note to Chair IWG-6 on Space Service Issues for Future Conferences
IWG-5/33	IWG-5 Meeting Agenda November 14
IWG-5/34	Interim Report to the IAC - Draft Outline
IWG-5/35	Additional Frequency Allocation Near 60 GHz for the Inter-Satellite Service (ISS)
IWG-5/36	IWG-5 Meeting Minutes October 18
IWG-5/37	IWG-5 Meeting Minutes November 14
IWG-5/38	Orbital Sciences Corporation Paper in Support of a Worldwide Upgrade to the EESS Allocation in the 8025-8400 MHz Band
IWG-5/39	IWG-5 Meeting Agenda December 6
IWG-5/40	IWG-5 Meeting Minutes December 6
IWG-5/41	Liaison Note to IWG-6 Opposing Proposed Deletion of Space Service Issues from the WRC-97 Agenda
IWG-6/42	IWG-5 Interim Report to the Industry Advisory Committee

#### **4.6.4 Definition of Terms and List of Acronyms**



# Definition of Terms

## General Terms

### Telecommunication:

Any transmission, emission or reception of signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.

**Allocation:** (of a frequency band) Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned.

### Radio Waves or Hertzian Waves:

Electromagnetic waves of frequencies arbitrarily lower than 3000 GHz, propagated in space without artificial guide.

### Radiocommunication:

Telecommunication by means of radio waves.

### Terrestrial Radiocommunication:

Any radiocommunication other than space radiocommunication or radio astronomy.

### Space Radiocommunication:

Any radiocommunication involving the use of one or more space stations or the use of one or more reflecting satellites or other objects in space.

### Radiodetermination:

The determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves.

### Radionavigation:

Radiodetermination used for the purposes of navigation, including obstruction warning.

**Radiolocation:**

Radiodetermination used for purposes other than those of radionavigation.

**Radio Astronomy:**

Astronomy based on the reception of radio waves of cosmic origin.

**Radio Services**

**Radiocommunication Service:**

A service as defined in this Section involving the transmission, emission and/or reception of radio waves for specific telecommunication purposes.

**Fixed Service:** A radiocommunication service between specified fixed points.

**Fixed-Satellite Service:**

A radiocommunication service between earth stations at given positions, when one or more satellites are used; the given position may be a specified fixed point or any fixed point within specified areas; in some cases this service includes satellite-to-satellite links, which may also be operated in the inter-satellite service; the fixed-satellite service may also include feeder links for other space radiocommunication services.

**Inter-Satellite Service:**

A radiocommunication service providing links between artificial satellites.

**Space Operation Service:**

A radiocommunication service concerned exclusively with the operation of spacecraft in particular space tracking, space telemetry and space telecommand. (These functions will normally be provided within the service in which the space station is operating.)

**Mobile Service:**

A radiocommunication service between mobile and land stations, or between mobile stations.

**Mobile-Satellite Service:**

A radiocommunication service:

- between mobile earth stations and one or more space stations, or between space stations used by this service; or
- between mobile earth stations by means of one or more space stations.

This service may also include feeder links necessary for its operation.

**Radiodetermination Service:**

A radiocommunication service for the purpose of radiodetermination.

**Radiodetermination-Satellite Service:**

A radiocommunication service for the purpose of radiodetermination involving the use of one or more space stations. This service may also include feeder links necessary for its own operation.

**Radionavigation Service:**

A radiocommunication service for the purpose of radionavigation.

**Radionavigation-Satellite Service:**

A radiodetermination satellite service used for the purpose of radionavigation. This service may also include feeder links necessary for its operation.

**Radiolocation Service:**

A radiodetermination service for the purpose of radiolocation.

**Radiolocation-Satellite Service:**

A radiodetermination satellite service used for the purpose of radiolocation. This service may also include feeder links necessary for its operation.

**Earth Exploration-Satellite Service:**

A radiocommunication service between earth stations and one or more space stations, which may include links between space stations, in which:

- information relating to the characteristics of the Earth and its natural phenomena, including data relating to the state of the environment, is obtained from active sensors or passive sensors on Earth satellites;
- similar information is collected from airborne or Earth-based platforms;
- such information may be distributed to earth stations within the system concerned;
- platform interrogation may be included.

This service may also include feeder links necessary for its operation.

**Meteorological-Satellite Service:**

An earth exploration-satellite service for meteorological purposes.

**Space Research Service:**

A radiocommunication service in which spacecraft or other objects in space are used for scientific or technological research purposes.

**Radio Astronomy Service:**

A service involving the use of radio astronomy.

**Radio Stations and Systems**

**Station:** One or more transmitters or receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location for carrying on a radiocommunication service, or the radio astronomy service. A station is classified by the service in which it operates permanently or temporarily.

**Earth Station:** A station located either on the Earth's surface or within the major portion of the Earth's atmosphere and intended for communication:

- with one or more space stations; or
- with one or more stations of the same kind by means of one or more reflecting satellites or other objects in space.

**Space Station:**

A station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere.

**Fixed Station:** A station in the fixed service.

**Mobile Station:**

A station in the mobile service intended to be used while in motion or during halts at unspecified points.

**Radar:** A radiodetermination system based on the comparison of reference signals with radio signals reflected, or retransmitted, from the position to be determined.

**Space System:**

Any group of cooperating earth stations and/or space stations employing space radiocommunication for specific purposes.

**Satellite System:**

A space system using one or more artificial earth satellites.

**Satellite Network:**

A satellite system or a part of a satellite system, consisting of only one satellite and the cooperating earth station.

**Satellite Link:**

A radio link between a transmitting earth station and a receiving earth station through one satellite. A satellite link comprises one up-link and one down-link.

**Feeder Link:** A radio link from an earth station at a given location to a space station, or vice versa, conveying information for a space radiocommunication service other than for the fixed-satellite service. The given location may be at a specified fixed point, or a any fixed point within specified areas.

**Operational Terms**

**Telemetry:** The use of telecommunication for automatically indicating or recording measurements a distance from the measuring instrument.

**Space Telemetry:**

The use of telemetry for the transmission from a space station of results of measurements made in a spacecraft, including those relating to the functioning of the spacecraft.

**Space Telecommand:**

The use of radiocommunication for the transmission of signals to a space station to initiate, modify or terminate functions of equipment on an associated space object, including the space station.

**Space Tracking:**

Determination of the orbit, velocity, or instantaneous position of an object in space by means of radiodetermination, excluding primary radar, for the purpose of following the movement of the object.

**Emission Characteristics**

**Out-of-band Emission:**

Emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

**Spurious Emissions:**

Emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

**Unwanted Emissions:**

Spurious emissions and out-of-band emissions.

**Interference:** The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.

## **Technical Terms Relating to Space**

**Deep Space:** Space at a distance from the Earth equal to, or greater than 2 million kilometers.

**Active Sensor:**

A measuring instrument in the Earth exploration-satellite service or in the space research service by means of which information is obtained by transmission and reception of radio waves.

**Passive Sensor:**

A measuring instrument in the Earth exploration-satellite service or in the space research service by means of which information is obtained by reception of radio waves of natural origin.

**Geosynchronous Satellite:**

An earth satellite whose period of revolution is equal to the period of rotation of the Earth about its axis.

**Geostationary Satellite:**

A geosynchronous satellite whose circular and direct orbit lies in the plane of the Earth's equator and which thus remains fixed relative to the Earth; by extension, a satellite which remains approximately fixed relative to the Earth.

**Low Earth Orbit:**

A orbit which exists between approximately 600 km and 2000 km above the Earth's surface.

## 5.6.4 List of Acronyms

CCIR	International Radio Consultative Committee
CPM	Conference Preparatory Meeting
dB	decibel(s)
dBW	decibels referred to 1 watt of power
e.i.r.p.	equivalent isotropically radiated power
EESS	Earth Exploration-Satellite Service
FCC	Federal Communications Commission
FSS	Fixed Satellite Service
GHz	gigahertz
IAC	Industry Advisory Committee
IFRB	International Frequency Registration Board
IRAC	Interdepartment Radio Advisory Committee
ISL	Inter-Satellite Link
ITU	International Telecommunication Union
ITU-R	Radiocommunication Sector of the ITU
IWG	Informal Working Group
JIWP	Joint Informal Working Party
JWP	Joint Working Party
KHz	kilohertz
km	kilometer(s)
LEO	Low Earth Orbit
m	meter(s)
MHz	megahertz
MSS	Mobile Satellite Service
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NGSO	Non-Geostationary Orbit
NGSO-FSS	Non-Geostationary Orbit Fixed Satellite Service
pfd	power flux density
RBW	Reverse Band Working
RCS	Radio Conference Subcommittee
RR	Radio Regulation
SAR	Synthetic Aperture Radar
SG	Study Group
SRS	Space Research Service
TDRSS	Tracking and Data Relay Satellite System
TG	Task Group
TRMM	Tropical Rainfall Measuring Mission
USTG	United States Task Group



USWP	United States Working Party
$\text{W/m}^2/4 \text{ kHz}$	Watts per square meter per 4 kilohertz of bandwidth
WARC	World Administrative Radio Conference
WMO	World Meteorological Organization
WP	Working Party
WRC	World Radiocommunication Conference